

Claims

[c1] What is claimed is:

1.A method of forming adjacent holes on a semiconductor substrate, wherein the adjacent holes separated by a fine line structure are a first hole and a second hole, the method comprising:

providing a semiconductor substrate with an insulating layer on the substrate;

forming a step-shaped structure on the surface of the insulating layer, the step-shaped structure comprising a first horizontal surface, a second horizontal surface, and a vertical surface between the first horizontal surface and the second horizontal;

depositing a sacrificial layer with an average thickness on the first horizontal surface, the second horizontal surface, and the vertical surface;

forming a patterned photoresist layer on portions of the first and second horizontal surface;

performing an etch-back process to remove the sacrificial layer not covered by the patterned photoresist layer and form a spacer on the vertical surface;

removing the patterned photoresist layer; and

using the spacer and the remaining sacrificial layer as a

hard mask to remove the insulating layer to form the two adjacent holes.

- [c2] 2.The method of claim 1, wherein a bottom width of the spacer is approximately equal to a width of the fine line structure.
- [c3] 3.The method of claim 1, wherein the width of the fine line structure is approximately smaller than the 100 angstroms (Å).
- [c4] 4.The method of claim 1, wherein the insulating layer comprises undoped silicate glass (USG) and borophosphosilicate glass (BPSG).
- [c5] 5.The method of claim 1, wherein the insulating layer comprises a first insulating layer and a second insulating layer on the first insulating layer.
- [c6] 6.The method of claim 5, wherein a surface layer of the first horizontal surface and the second horizontal surface is the first insulating layer.
- [c7] 7.The method of claim 5, wherein the first insulating layer is an USG layer, and the second insulating layer is a BPSG layer.
- [c8] 8.The method of claim 1, wherein a step height difference is formed between the first and second horizontal sur-

face, and a thickness of the sacrificial layer is approximately equal to the step height difference.

[c9] 9.The method of claim 1, wherein the sacrificial layer is a liner silicon nitride layer.

[c10] 10.The method of claim 1, wherein the etch-back process is a dry-etching process.

[c11] 11.The method of claim 1, wherein a height of the first horizontal surface is lower than a height of the second horizontal surface.